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410191

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N-63-4-3

TM-1138

Operating Instructions for the
Parameter Test System

Milestone 7

TECHNICAL MEMORANDUM

(TM Series)

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Systems Division Program, for Space Systems Division, AFSC.

Operating Instructions for the
Parameter Test System
Milestone 7

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25 March 1963

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A. An Introduction to the COPII Parameter Test System

1. The Parameter Test Concept - A Definition

A Parameter Test is a controlled run of an object program designed to verify, or debug, the coding and the logical design of the program's function. An object program is defined as a segment of a computer system, e.g., a program, subroutine, or even a string of a few instructions. Such a test consists of: 1) artificially creating an environment in which the object program can be operated in a known and controlled manner, 2) operating the object program, and 3) sampling data during the run for evaluation of the object program's performance. This document describes a parameter test system which performs these operations in a versatile, yet simple and efficient manner.

2. The Parameter Test System - An Overview

The Parameter Test System has many useful features and options available to the tester. It makes available testing devices in a conveniently usable form, relieving the tester of the effort required to construct his own test vehicle. If the tester is familiar with the Parameter Test System features, he should be able to design a test which will satisfy the unique requirements of his program, permitting rapid and thorough parameter testing.

The Parameter Test System consists of three programs. The first, the Reference Pool Simulator (SRPS), sets the reference pool to predetermined values. The second program, Test Control (STCP), 1) sets additional environment such as tables, items, and core locations before and during the object program's operation; 2) provides dumps of tables, programs, and core areas before, during, and after the test; 3) allows a trace of selected areas of the object program; 4) controls the start, operation, and the end of the test; and 5) provides for emergency

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procedures in case of certain test failures. The third program, Data Reduction (SDRP), selectively formats and lists the test outputs. Each of these programs reads input data via the card reader, magnetic tape, or typewriter. Normally, the inputs would be combined into one test deck; however, any of the programs can be run individually. This document considers each of these programs and their features in detail in subsequent sections.

B. The Reference Pool Simulator (SRPS)

1. SRPS Description

a. Program Function

SRPS, the Reference Pool Simulator, sets Reference Pool items and tables to values input by card, magnetic tape, or typewriter. Two Reference Pools may be set by SRPS, the Standard Pre-Augmentation and the Augmentation Reference Pools. Any other Reference Pools in existence can not presently be set by SRPS.

b. Subroutines Used

SRPS uses the I/O routines in MTCII and the free field conversion subroutine, FFCONV.

c. Input Formats

SRPS is called by a "* SRPS" function request. This card causes MTCII to read SRPS into memory and yield control to it. SRPS then proceeds to input data via the central I/O routines. SRPS expects to encounter its first input from the card reader or typewriter. The card reader is checked first. If it is not ready, input control is given to the typewriter. This first input must have the following format:

<u>Field 1</u>	<u>Field 2</u>	<u>Field 3</u>
SETPool or SETPOOLA	CARD, TYPE, or TAPE	Blank or a Tape
(Standard Reference Pool)	(Augmentation Reference Pool)	Unit number

The first field indicates which Reference Pool is to be set. The second field indicates the I/O source of the remaining data. The third field indicates a tape unit number, 1-12 or 16-19, if field

two was "TAPE". The input values are then read from the appropriate device. The input format is as follows:

<u>Field 1</u>	<u>Field 2</u>	<u>Field 3</u>
Table or Item Name	Relative location in the table to store the value. This field is "0" if the relative location is the first cell of the table or if the name in field one is an item.	The number of consecutive cells within the table, beginning at the relative location given in field 2, to be set to the value given in field four.
<u>Field 4</u>	<u>Field 5, etc.</u>	<u>Last Field</u>
The first value input. It may be octal, decimal, floating point, or BCD. Refer to page 45 for formats.	Other value inputs. These values are stored into consecutive cells behind the first value. These fields have significance only if field three is "0".	May be a "\$" to indicate that another card or prestored card follows with more values for this table. The values on the next card begin in field one. Do not use a "\$" if inputs are typed.

2. Output

The program output consists of a modified Reference Pool. A listing of all inputs read by SRPS is printed on the line printer. If any errors occur, error messages are listed just below the offending input. Any error messages are also output on the typewriter.

3. Program Operation

a. Error Messages

- 1) ERROR. THE FIRST DATA FIELD IS NOT -SETPOOL- OR -SETPOOLA-
- 2) ERROR. THE SECOND FIELD IS NOT A LEGAL INPUT. IT MUST BE -CARD-, -TAPE-, OR -TYPE-.
- 3) ERROR. TABLE OR ITEM NOT IN REFERENCE POOL. CORRECT AND CONTINUE IF INPUT IS NOT ON TAPE.
- 4) ERROR. BAD TAPE READ. CARD WILL BE PROCESSED ANYWAY.

b. Recovery Procedure

Error messages on the typewriter should be monitored by the operator. If one of the first two messages is typed, the input must be corrected before continuing. If either of the other two messages is typed, the operator should follow the instructions submitted with the job. To continue may or may not result in a correct Reference Pool and a useful test.

c. Stops

The only stops in the program are error stops which follow the printing and typing of an error message. This allows the erroneous input to be corrected. "Continuing" causes the next input to be read. The exception to this is if the input value in error is on magnetic tape. In this case the error message is printed and typed and the input is ignored, but no halt occurs.

d. Restrictions

Only 80 characters may be typed as an input. No \$'s are allowed, when typing, to signify a continuation of data.

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e. Operator Feedback

The line printer listing, showing inputs and error messages, should be returned by the operator to the requestor after the program is complete.

4. Sample Input Deck

SETPOOL CARD

```
LFPA   1   0   1.748259080
DAYTAB 0   3   34
GC      0   0   1716.4827   1.407
SBCD    0   0   B1   (----- PAD)   $
B2      (---- PAD2 ---- PAD3)
END
```

C. Test Control Program (STCP)

1. STCP Description

a. Program Function

STCP interprets various types of input messages which initiate the setting of test environment data, recording traps, and trace traps. The program also controls the output of memory dumps, table and item dumps, traces, and the inactivity check of the object program.

STCP and the object program are read into memory by separate function requests. The STCP request puts MTCII in the Parameter Test Mode of operation. MTCII then reads the object program's function request. The object program and its corrections, if any, are read into memory and the calling sequence is constructed by MTCII from the parameters on the function card. MTCII then reads in STCP and gives it control.

STCP first builds a directory of table and item information from data input in the ENVIR Messages. This directory is the source of information when other inputs use a defined table or item. The object program's test environment is then set from the "S" and Value Input Messages. If test environment settings are desired during the object program's operation, SIM Input Messages are used. Dumps of core, tables and items, before, during, and/or after the object program's operation, are set up by RECORD Input Messages. TRACE Input Messages set traps to trace the given areas of the object program. The OPERATE Input Message provides the object program's calling sequence, if desired, then operates the object program.

b. Subroutines Used

STCP uses the MTCII input/output subroutines, TAPEIO, CARDIO, TYPEIO, and PRNT1612. All conversion of input data is done by FFCONV.

c. Function Request

*STCP P_1

Where P_1 is the tape unit of the prestored control inputs. P_1 is optional and if it is not specified the card reader will be assumed. STCP attempts to read the TEST input message from the tape unit specified.

d. Control Input Formats

All of the control inputs are in the free field format. When a control input is entered by the typewriter it is terminated by a carriage return. To correct an error in a typed input a backspace is typed. After the image is cleared and the carriage is returned, the input may then be retyped. A description of the various types of field entries is given in the Appendix, page 45.

1) TEST Input Message

This input must be the first one read by STCP.

Field 1 - TEST Identification

Field 2 - Method of input

CARD card reader

TAPEXX where XX is the tape number of the prestored inputs.

TYPE Typewriter

NONE No inputs

Field 3 - Tape unit number of the output tape.

Field 4 - Number of seconds the object program should operate before inactivity is assumed. The entry may be either octal or decimal. If no time check is desired, the entry is zero.

Field 5 - Object program name

Field 6 - The address of the final instructions to be operated. This field is used only if the final instructions desired are other than the object program's normal exits.

Relocatable address - the relative octal address.

Absolute address - F followed by the absolute octal address.

Zero = use normal exits.

Field 7 - Number of repeat passes. The octal or decimal entry indicates the number of operations of the object program desired in addition to the initial pass.

Zero = initial pass only.

Example:

TEST CARD 2 0 TEST 0 0

2) ENVIR Input Message

The ENVIR input is used to define tables and items for STCP. All table and items referred to by other control inputs must be defined by an ENVIR input.

Field 1 - ENVIR Identification

Field 2 - Name of table or item. The name must not exceed 8 characters, and the first character must be a letter.

Field 3 & 4 The starting address of the entry.

Relocatable address:

Field 3 - the name of the program with which the entry is associated.

Field 4 - the relative octal starting address within the program.

Absolute address:

Field 3 - 0

Field 4 - Absolute octal address of entry.

Field 5 - Length of the entry, either octal or decimal. Items have a length of 1.

Field 6 - Format code of entry

1 = octal

2 = floating point

3 = decimal

4 = BCD code

5 = teletype code

6 = typewriter code

7 = mixed format

Field 7 - Scaling of entry. Binary scaling of entry is to be used for output by the Data Reduction Program. The number may range from 0-47 and may be entered as octal or decimal.

Example:

ENVIR TABLE1 TEST 2000B 50 1 0

3) Test Environment Input Messages

The Test Environment Inputs must be grouped in the following manner:

"S" input - informs STCP to operate the test environment routine.
Must be the first input in the group.

SIM and/or Value input messages

END input - informs the test routine of STCP that its functions are complete. This input must be the last input in the group.

Within the entire input deck there may be more than one test environment group.

a) "S" Input message

This input starts the test environment function and sets the A, Q, and index register. To set the Q register, or an index register, all fields prior to the desired one must be set to a value, or zero.

Field 1 - "S" Identification

Field 2 - A register value.

The value may be octal or decimal.

Field 3 - Q register value.

The value may be octal or decimal.

Field 4 - Index register 1 value.

The value may be either octal or decimal.

The descriptions for Fields 5-9, setting indexes 2-6 are the same as Field 4.

Field 5 - Index register 2 value

Field 6 - Index register 3 value

Field 7 - Index register 4 value

Field 8 - Index register 5 value

Field 9 - Index register 6 value

Example:

S 77B 0 5 1 0 2 0 1

b) SIM Input Message

Informs STCP of an address within the object program, where environment setting is desired. For each SIM exit, STCP expects one Test Environment Input group following the OPERATE input.

Field 1 - SIM Identification

Field 2 & 3 Address for test environment setting.

Relocatable address:

Field 2 - Program name

Field 3 - Relative octal address within the program

Absolute address:

Field 2 - 0

Field 3 - Absolute octal address within the program.

Example:

SIM 0 70021B

c) Value Input Message

The value input is used to set tables, items, and memory locations. Depending on the input, the Test Environment Routine sets values by one of the following methods:

1. Sets an item, or memory register, to a given value.
2. Sets consecutive registers in a table, or area of memory, to one given value.
3. Sets consecutive registers in a table, or area of memory, to consecutive values in the input.

Field 1 - Name of memory area. Table, or item name, which has been defined by an ENVIR input or CORE.

Field 2 & 3 have different meanings for table, or item, or CORE entries.

Table or Item Entry:

Field 2 - 0

Field 3 - Relative octal or decimal location

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within the entry to set the first value. The field is zero for items.

CORE Entry:

The two fields are used to give the starting address in memory to set the first value.

Relocatable address:

Field 2 - Program name

Field 3 - Relative octal or decimal starting address

Absolute address:

Field 2 - 0

Field 3 - Absolute octal starting address

Field 4 - The number of consecutive registers to be set to the first value given. If this function is not desired, the field must be zero.

Field 5 and the remaining fields are used for test environment values. The values may be in any of the value formats. If more than one input is necessary to provide all the values for an entry, additional value inputs may be used. A \$ in the last field of an input informs STCP that an additional input is present. STCP will continue to read and process additional value inputs for an entry until an input without a \$ is encountered.

Example:

CORE TEST 200 0 1 2 3 4 5 6 7 8 9 \$

d) Additional Value Input Message

All of the fields in this input are used for test environment values. The value format will be the same as that used on the Value Input. The \$ may be used to read and process more Additional Value Inputs.

Example:

1) 10 11 12 13 14 15 16 17 18 19 20 21 \$

2) 22 23 24 25 26

4) RECORD Input Messages

The record inputs cause dumps of memory, tables, and items before, during, and/or after the object program operation. There are 4 types of RECORD Input Messages.

a) Table or Item RECORD Input Message

The table or item referred to by this input must have been defined by an ENVIR input.

Field 1 - RECORD Identification

Field 2 - Name of table or item defined by ENVIR input.

Field 3 & 4 Address in the object program when the dump is to be made.

Relocatable address:

Field 3 - Name of the program in which the trap will be placed.

Field 4 - Relative octal address in the program.

Absolute address:

Field 3 - 0

Field 4 - Absolute octal address of the trap.

Field 5 - "Before" and "After" dump indicator.

B = "Before" dump

A = "After" dump

BA or AB = both

0 = No "Before" or "After" dump desired.

Field 6 - Number of the first dump of this entry to be processed by Data Reduction. Octal or decimal record number. Zero for process all dumps for this entry.

Field 7 - Number of the last dump of this entry to be processed by Data Reduction. Octal or decimal record number. Zero for process all dumps for this entry.

Example:

RECORD TABLE1 0 20000B BA 0 0

b) CORE RECORD Input Message

This input is used to dump undefined areas of memory.

Field 1 - RECORD Identification

Field 2 - CORE

Field 3 & 4 Address in the object program when the dump is to be made.

Relocatable address:

Field 3 - Name of the program in which the trap is placed.

Field 4 - Relative octal address in the program.

Absolute address:

Field 3 - 0

Field 4 - Absolute octal address of the trap.

Field 5 - "Before" or "After" dump indicators.

B = "Before" dump

A = "After" dump

BA or AB = both

O = No "Before" or "After" dumps desired.

Field 6 - Number of memory locations to be dumped. Octal or decimal entry.

Field 7 & 8 The starting address of the dump.

Relocatable address:

Field 7 - Object program name associated with the area to be dumped.

Field 8 - Relative octal starting address in the object program.

Absolute address:

Field 7 - 0

Field 8 - Absolute octal starting address.

Field 9 - Number of the first dump of this entry to be processed by Data Reduction. Octal or decimal record number. Zero for process of all dumps for this entry.

Field 10 - Number of the last dump of this entry to be processed by Data Reduction. Zero for process of all dumps for this entry.

Example:

RECORD CORE TEST 30B A 2000B 0 30000B 0 0

c) CONSOLE RECORD Input Message

This input gives the contents of the A, Q, and index registers, plus the buffer registers and the clock.

Field 1 - RECORD Identification

Field 2 - CONSOLE

Field 3 & 4 Address in the object program when the dump is to be made.

Relocatable address:

Field 3 - Name of the program in which the trap is placed.

Field 4 - Relative octal address in the program.

Absolute address:

Field 3 - 0

Field 4 - Absolute octal address of the trap.

Field 5 - "Before" or "After" dump indicators.

B = "Before" dump

A = "After" dump

BA or AB = both

0 = No "Before" or "After" dumps desired.

Field 6 - Number of the first dump of this entry to be processed by Data Reduction. Octal or decimal record number. Zero for process all dumps for this entry.

Field 7 - Number of the last dump of this entry to be processed by Data Reduction. Octal or decimal record number. Zero for process all dumps for this entry.

Example:

RECORD CONSOLE 0 0 AB 0 0

d) POOL RECORD Input Message

This input dump specifies portions of the Reference Pool. To have the reduced output listed by table and item name, the dump starting address must be the first location of a table or item. If the starting address is not a table or item location, the output will be an octal dump.

- Field 1 - RECORD Identification
- Field 2 - POOL if the pre-Augmentation reference pool, or
POOLA if the Augmentation reference pool.
- Field 3 & 4 Address in the object program when the dump is
to be made.
Relocatable address:
Field 3 - Name of the program in which the trap
is placed.
Field 4 - Relative octal address in the program.
Absolute address:
Field 3 - 0
Field 4 - Absolute octal address of the trap.
- Field 5 - "Before" or "After" dump indicators
B = "Before" dump
A = "After" dump
BA or AB = both
0 = No "Before" or "After" dumps desired.
- Field 6 - Absolute octal starting address in the Reference
Pool.
- Field 7 - Octal or decimal number of Reference Pool lo-
cations to dump.
- Field 8 - Number of the first dump of this entry to be
processed by Data Reduction. Octal or decimal
record number. Zero for process all dumps for
this entry.
- Field 9 - Number of the last dump of this entry to be
processed by Data Reduction. Octal or decimal
record number. Zero for process all dumps for
this entry.

Example:

RECORD POOL TEST 60B AB 5000B 100 0 0

5) TRACE Input Message

This input sets up a trace of the object program.

Field 1 - TRACE Identification

Field 2 - Object program name for relocatable addresses.
If any of the following fields set a relocatable address, this field must contain the program name.
If the following two addresses are absolute, this field must be zero.

Field 3 - Starting trace address.
Relocatable address - relative octal starting address.
Absolute address - absolute octal starting address.

Field 4 - Final address to be traced.
Relocatable address - relative octal final address.
Absolute address - absolute octal final address.

Field 5 - Lower trace limit below which Trace will operate with no output.
Relocatable address - relative octal lower limit address.
Absolute address - F followed by an absolute octal address.

Field 6 - Upper Trace limit, above which Trace will operate with no output.
Relocatable address - relative octal upper limit address.
Absolute address - F followed by an absolute octal address.

Example:

TRACE TEST 1 100B F7777B 105B

6) OPERATE Input Message

This input provides the object program calling sequence, if desired, and informs STCP to operate the object program.

Field 1 - OPERATE Identification

Field 2 and following contain the desired calling sequence.

The field representing the normal return will contain an "N". The field or fields representing the error return will contain an "E". The other fields are entered as octal or decimal values. If more than one input is necessary, a \$ is placed in the last field and the parameters are continued on the next input. BCD word parameters are entered as one field as shown in the example. Teletype and typewriter code parameters must be in octal format.

Example:

OPERATE E 02533B ABCDEFG 2 N

2. Input/Output

a. Inputs

- 1) COPII Master tape on unit 1.
- 2) An output tape.
- 3) Prestored control input tape (optional).
- 4) An object program: binary deck, prestored binary deck, or program on the master tape.
- 5) Deck of control inputs or a list to be typed. If the card reader is not ready, input control is given to the typewriter.

b. Outputs

- 1) STCP outputs all control inputs read and processed on the on-line printer.

- 2) All input error and operator information messages are output on the typewriter and the on-line printer.
- 3) STCP outputs a binary tape containing all memory dumps, table and item dumps, traces, console dumps, and control tables necessary for Data Reduction to process the tape.

3. Program Operation

a. Tapes

Unit 1 - COPII Master Tape

Unit X - Prestored function Request Tape, where X is the unit (optional) specified by MTCII. If the entire test deck (MTCII function cards, STCP TEST input card, and the STCP control inputs) is prestored, P_1 on the *STCP P_1 function request must be X. Also Field 2 of the TEST input, the control input prestore tape number, must be X.

Unit 3 - COPII System Output Tape

Unit Y - STCP output tape, where Y is the unit specified in Field 3 of the TEST input.

Unit Z - STCP control inputs prestored tape, where Z is the unit (optional) specified in Field 2 of the TEST input. X may equal Z.

b. Jump and Stop Keys

Jump key 1 is the only key used by STCP. After an error halt, the operator may correct the input from the typewriter. When STCP halts, if SLJ key 1 is activated, the typewriter is given input control when the program is restarted. STCP processes the typed input, then returns to the original input source for the remaining inputs.

If the SLJ key 1 is not activated when STCP is restarted, the erroneous input is ignored.

c. On-line Messages

The following messages are output on the on-line printer and the typewriter. The error message on the on-line printer follows the input which is in error.

<u>Message</u>	<u>Explanation</u>	<u>Operator Action</u>
PARITY - TEST INPUT RECORD - TYPE INPUT	There is a parity in the TEST input pre-stored records. Program halts.	An attempt to print the input has been made. If legible, activate start and type desired Test input. If the input can not be typed, the inputs must be prestored again and the job repeated.
ERROR - TEST INPUT PARAMETERS	Parameters in the Test input are in error. Program halts.	If possible, correct TEST input and activate the start switch. Otherwise, return job to programmer.
ERROR - FIRST INPUT NOT TEST	The first control input must be the TEST input. Program halts.	If possible, correct the input sequence, placing the TEST input first. Otherwise, return job to programmer.
ERROR - PARITY - PROCESSING CONT.	Parity error encountered while reading the input tape. Program halts.	Prestore inputs and run the job again.
ERROR - LENGTH - PROCESSING CONT.	Buffer length error encountered while reading input tape. Program halts.	Prestore inputs and run the job again.
ERROR - BAD CONTROL INPUT	Input is not one of the 5 control input types: ENVIR, S, RECORD, TRACE, or OPERATE. Program halts.	Correct card, if possible, then activate start to continue processing. If correction is not possible, activate start to validate the remaining inputs.

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<u>Message</u>	<u>Explanation</u>	<u>Operator Action</u>
ERROR - INPUT PARAMETERS	Parameters in control input are in error. Program halts.	Same as above.
ERROR - TOO MANY ENVIR INPUTS	Maximum number of ENVIR inputs has been exceeded. Program halts.	Activate start to validate remaining inputs, then return job to programmer.
ERROR - TOO MANY SIM INPUTS	Maximum number of SIM inputs has been exceeded. Program halts.	Same as above.
ERROR - NAME NOT DEFINED	Name of test environment to be set was not defined by ENVIR. Program halts.	Same as above.
ERROR - TOO MANY TRACE INPUTS	Maximum number of TRACE inputs has been exceeded. Program halts.	Same as above.
ERROR - TOO MANY RECORD INPUTS	Maximum number of RECORD inputs has been exceeded. Program halts.	Same as above.
UNIT X NOT READY	The output tape (X) is not ready. Program halts.	Ready output tape and activate start switch to continue.
PARITY ON OUTPUT TAPE	Parity error on the output tape. Program halts.	Load a new blank output tape and repeat the job.
BUFFER LENGTH ON OUTPUT TAPE	Buffer length error on output tape. Program halts.	Rewind the output tape and repeat the job.
OUTPUT TAPE FULL. REPLACE AND CONTINUE	The end of tape mark has been sensed on the output tape. An end of file is written on the tape, it is rewound with interlock, and the program halts.	Load a new blank output tape and activate start to continue.

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<u>Message</u>	<u>Explanation</u>	<u>Operator Action</u>
TEST CONTROL FUNCTIONS FINIS	STCP functions are complete and control is being given to MTCII.	No action.
HALT OBJECT PROGRAM	The object program halts. The operator gave control to STCP at its halt entrance.	No action.
LOOP OBJECT PROGRAM	The object program looped. The operator stopped the object program and gave control to STCP at its loop entrance.	No action.
INACTIVITY OBJECT PROGRAM	The object program has run longer than the inactivity time given in the TEST input.	No action.
2 MIN. ADDED TO TIME	Two additional minutes have been added to the original inactivity time. The object program did not complete its operation during the additional time.	No action.
ERROR RETURN FROM SUBROUTINE	The object program is a subroutine and its operation ended in an error return to STCP.	No action.
VALIDATION MODE- DEACT SLJ KEY 1 - HIT START FOR TEST	One or more input errors have been detected. Program halts.	If the errors detected have been corrected by the operator, or the errors are insignificant, activate start to continue the run. Otherwise return the job to the programmer.

d. Recovery Procedure

The operator should monitor the typewriter for output messages. If an error message is typed and the computer halts, the operator should check the printer for the control input in error. If a correction can be made, activate SLJ key 1 and start computer. When a plus (+) sign is typed, enter corrected control input and carriage return. If an error is made in the typed input, it may be corrected by typing a colon or a semi-colon. After the input image is cleared and the carriage is returned, the correct input may then be typed.

If the object program halts, the operator must return jump to address 71001 to give STCP control.

If the object program loops, the operator must stop the computer, step to an upper instruction, and return jump to address 71002 to give STCP control.

When STCP halts without an output message, the object program has altered the area between 71000 and 76000. Take a memory dump and indicate on the job request that the object program wiped out the Test Control Program.

e. Stops

There are two types of stops in STCP: input error and operator information. All stops are accompanied by an output message giving the reason for the halt. All halts require that a judgment or action be performed by the operator. The output messages and the operator reactions are described in the On-Line Messages, page 22.

f. Restrictions and Limitations

- 1) A maximum of 100 ENVIR input messages may be used in a test.
- 2) A maximum of 100 RECORD input messages may be used in a test.

- 3) A maximum of 25 SIM input messages may be used in a test.
 - 4) A maximum of 5 TRACE input messages may be used in a test.
 - 5) On the TRACE input, the final address in the object program to be traced may not contain an RTJ instruction.
 - 6) Trap addresses given on the RECORD and SIM input may contain an RTJ instruction with two restrictions. The subroutine jumped to must only return to the object program at the next memory register. Also, there may be no calling sequence parameters connected with the return jump. Another trap address must be selected if the above conditions are not satisfied.
 - 7) For repeat runs of the object program, all initial environment necessary to operate the program must be set by test environment inputs.
 - 8) Object programs which use the clock or interrupt may not use the inactivity check. Field 4 of the TEST Input must be zero.
 - 9) TRACE, RECORD, or SIM traps must not be placed in MTCII I/O routines.
 - 10) Programs using core beyond address 70777 may not use STCP.
 - 11) ADDR0F and Successor Call functions of MTCII can not be used with STCP.
 - 12) Only one STCP function (TRACE, RECORD, or SIM) may use a specific trap address. Each request must be for a different memory address.
- g. Operator Feedback
- The line printer listing, showing inputs, error messages, and information messages, should be returned by the operator to the requestor.

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4. Sample Input Deck

```
*CLR
*TESTPROG 300B
TEST CARD 5 0 TESTPROG 0 0
ENVIR TABLE1 TESTPROG 160B 50 1 0
ENVIR ITEM1 TESTPROG 151B 1 2 0
ENVIR AREA1 TESTPROG 220B 20B 4 0
S 0 -0 50
SIM TESTPROG 10
TABLE1 0 0 50 -0
CORE TESTPROG 20B 0 1201002020110050B
END
RECORD AREA1 TESTPROG 70B AB 0 0
RECORD ITEM1 TESTPROG 21B BA 0 0
TRACE TESTPROG 75B 147B
OPERATE
S
TABLE1 0 5 0 -0
END
```

D. Data Reduction Program (SDRP)

1. SDRP Description

SDRP is the data reduction program for the Parameter Test System. Its function is to list in a readable format the recording tape produced by STCP. This recording tape contains binary data records which were written as a result of the operation of the object program. All of the data records may be reduced automatically, or they may be selectively chosen for processing through the use of Selective Listing Input messages. These messages have the same format as the STCP recording messages.

Those subroutines used by SDRP are EOT, FFCONV, INFLEX, INPUT, OUTERR, OUTPUT, and TAPEIO. SDRP also references the communication registers EXITSTAT, IOBUFWD, and IOSTATUS.

The function request used to call SDRP is

*SDRP P₁ P₂ P₃

where P₁ = the input tape number.

P₂ = the output device. P₂ is set to either PRINTER if output is via the on-line printer, or to a logical tape number for tape output.

P₃ = change only printing option. P₃ is set to CHANGE if change only printing is desired, or to blank if regular printing is wanted. "Change only printing" refers to the method of printing the After Core Dump Record. If change only printing is requested, then only those registers in the After Core Dump which differ in content from the same registers in the

Before Core Dump are printed. If this option is omitted, the After Core Dump will be printed in the same manner as the Before Core Dump.

Restrictions: P_1 cannot equal P_2 . Legal tape numbers are 2-12 and 16-19. If $P_3 = \text{CHANGE}$, then P_1 and P_2 cannot equal 4.

2. SDRP Inputs

a. STCP Recording Tape

SDRP data inputs are contained on the STCP recording tape. This tape consists of one or more binary files, one file for each operation of the object program. The first and second records of each file are the Table and Item Directory and the Test Recording Table, respectively. The first word of the Table and Item Directory of the first file is used as an identification word for the tape. If the contents of the word do not check, the tape is rejected. Other requirements imposed by SDRP on the STCP recording tape are that the third record of the first file must be the Before Core Record, that a CONTINUE record immediately precede a physical end-of-tape, that an After Core Record may not be followed by any more data records, and that the last file of the run be followed by a double end-of-file mark.

b. Selective Listing Inputs (SLI)

1) Definition

An option to selectively process data is provided through the use of selective listing input messages. These messages are input to SDRP via either the card reader or typewriter. Their format and input method are the same as MICII free field control messages.

For each file on the input data tape, SDRP checks the input devices for possible SLI messages. If only a termination (END) message is found, all data records on that file are processed. If any SLI messages are read, then only those data records which correspond to SLI messages are reduced. For exceptions, see Restriction c in section 4) below.

First, the card reader is checked and SLI messages are read until either a termination message is found or until the reader becomes not ready. If the reader becomes not ready, control is given to the typewriter for the next message. After processing that message, the card reader is checked again. The program returns to the typewriter only if the card reader is still not ready. Typewriter message formats are the same as card message formats and each message is terminated by a carriage return.

2) Format

There are four possible types of SLI messages. Their formats are exactly the same as the RECORD message formats accepted by STCP. Therefore, a card message can be used as input for either program.

The last two fields (called START and FINIS) of each message provide a means for selectively choosing records of a specific during recording for processing. This option would most likely be used, for example, when a trap in an object program loop causes a table to be recorded many times.

All address and numerical values may be either octal or decimal, unless specifically stated otherwise. All octal values must be terminated by a B.

a) Table or Item Message

RECORD NAME A B C D E

where NAME = the name of the table or item.

A = the object program name to go with a relative address in field B. Equal to zero if field B is an absolute address, or if the option is not used.

B = the trap address for a during recording. It may be 1) a relative address in the object program, 2) an absolute address, or 3) zero for no during recording.

C = before and after recording indicators. May be equal to B, A, BA, AB, or zero.

D = the starting record of this entry to be processed. Equal to zero, or blank, if all records are processed.

E = the last record of this entry to be processed. Equal to zero, or blank, if all records are processed.

b) Core Memory Dump Message

RECORD CORE A B C D E F G H

where A = the object program name to go with a relative address in field B. Equal to zero if field B is an absolute address, or if the option is not used.

B = the trap address for a during recording. It may be 1) a relative address in the object program, 2) an absolute address, or 3) zero for no during recording.

C = before and after recording indicators. May be equal to B, A, BA, AB, or zero.

D = the number of words to be recorded. This entry is not used by SDRP and may be zero unless the message is intended as input for STCP.

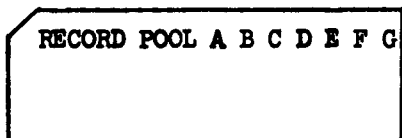
E = the object program name in which the memory dump will start. For relocatable addresses in F. Equal zero if F is absolute.

F = the address of the first word of the dump. May be relative or absolute.

G = the starting record of this entry to be processed. Equal to zero, or blank, if all records are processed.

H = the last record of this entry to be processed. Equal to zero, or blank, if all records are processed.

c) Reference Pool Message



where POOL = POOL if the pre-Augmentation reference pool is recorded or to POOLA if the Augmentation reference pool is recorded.

- A = the object program name to go with a relative address is field B. Equal to zero if field B is an absolute address, or if the option is not used.
- B = the trap address of a during recording. It may be 1) a relative address in the object program, 2) an absolute address, or 3) zero for no during recording.
- C = before and after recording indicators. May be equal to B, A, BA, AB, or zero.
- D = the absolute octal starting address in the reference pool for recording.
- E = the number of reference pool words to be recorded. Not used by SDRP. May be zero unless the message is intended as input for STCP.
- F = the starting record of this entry to be processed. Equal to zero, or blank, if all records are processed.
- G = the last record of this entry to be processed. Equal to zero, or blank, if all records are processed.

d) Console Message

RECORD CONSOLE A B C D E

- where A = the object program name to go with a relative address. Equal to zero if field B is an absolute address, or if the option is not used.
- B = the trap address of a during recording. It may be 1) a relative address in the object program, 2) an absolute address, or 3) zero for no during recording.

C = before and after recording indicators. May be equal to B, A, BA, AB, or zero.

D = the starting record of this entry to be processed. Equal to zero, or blank, if all records are processed.

E = the last record of this entry to be processed. Equal to zero, or blank, if all records are processed.

3) Termination Message

SDRP stops reading SLI messages when a termination message is read. Field 1 of the termination message must be equal to END. No other restrictions are placed upon the message.

4) Restrictions

- a) The contents of the first field of every message must equal RECORD.
- b) SDRP is unable to process relative trap and dump addresses. If an address is given in absolute form, it will be matched with the equivalent addresses in the Test Recording Table and in the data records. Otherwise, the parameter is ignored when data records are chosen for processing.
- c) Some records are processed automatically by SDRP and cannot be selectively chosen. They are the Before and After Core Dumps, the TRACE records, and all records generated as a result of an inactivity.

3. SDRP Operation

a. Tape Assignments

To operate SDRP, assign tapes as follows:

Tape unit 1: System utility master
Tape unit 3: System output
Tape unit 4: SDRP scratch tape
Tape unit X: STCP recording tape
Tape unit Y: SDRP output tape if applicable (3 may be used)

If change only printing is not requested, the scratch tape is not required. At the end of the run, SDRP writes an EOT on the output tape and rewinds both X and Y with interlock.

b. Input Deck

The control cards needed to operate SDRP are listed below. A SLI deck is not needed if all records in a data file are to be reduced. However, SDRP expects to find an END message for each file.

*CLR

*SDRP P₁ P₂ P₃

First selective listing input deck

END

Second selective listing input deck

END

Nth selective listing input deck

END

*FINIS

If errors are found in the function call parameters, a message is printed and control is given to the typewriter for a correction. If an SLI message has an error, an error note is printed and the message is discarded.

c. On-line Messages

On-line messages are divided between those messages which inform the operator of an action to be taken and those which provide information only. Messages written by COPII system subroutines are not listed.

1) Operator Messages

a) FIELD X OF FUNCTION CALL ILLEGAL. CORRECT ON TYPEWRITER

The program hangs waiting for typewriter input. The operator should type in a one-field message which will correct the illegal field. Before typing, the operator must shift the typewriter to lower case.

b) SDRP UNABLE TO RECOGNIZE INPUT TAPE. CORRECT TAPE REEL AND PRESS START

The first word of the first record was not a BCD "DIRECTRY" and, therefore, the tape is considered to be the wrong one.

c) CARD READER NOT READY. INSERT MESSAGE VIA TYPEWRITER

This message is printed if the card reader becomes not ready while reading SLI messages.

d) EOT READ. CHANGE INPUT TAPE AND PRESS START

SDRP will continue from the point of interruption.

e) PHYSICAL EOT DETECTED ON OUTPUT TAPE. CHANGE TAPE AND HIT START

f) INOPERATIVE OUTPUT EQUIPMENT SPECIFIED. CORRECT IF POSSIBLE AND HIT START

2) Information Messages

a) INPUT TAPE PARITY ERROR

A parity error occurred while reading the STCP recording tape. If the record which caused the parity error was a data record, it is rejected. Otherwise, the program attempts to use it anyway.

b) OUTPUT ERROR X

This message is printed if an error occurs while writing a BCD data message. X = the error number generated by OUTPUT.

c) CARD INPUT ERROR X

This message is printed if an error occurs while reading SLI card messages. X = the error number generated by INPUT.

d) BINARY SCRATCH TAPE PARITY ERROR

A parity error occurred while reading, or writing, the SDRP scratch tape.

e) BINARY SCRATCH TAPE BUFFER LENGTH ERROR

A buffer length error occurred while reading, or writing, the SDRP scratch tape.

f) SELECTIVE LISTING INPUT TABLE CAPACITY EXCEEDED. NO MORE INPUTS WILL BE RECOGNIZED

SDRP discontinues reading SLI messages for the data file.

g) SDRP OPERATION COMPLETED. PLEASE LIST LOGICAL TAPE XX

Termination message.

d. Stops

SDRP halts after printing messages b, d, e, and f of Operator Messages, page 36. To continue operation after any halt, simply press the Start-Stop lever upward. SDRP should never halt without writing a message.

e. Restrictions and Limitations

- 1) The STCP recording tape is not rewound before reading the first record.

- 2) Only 100_{10} Selective Listing Input messages can be accepted for any one data file.
- 3) There is no limitation on the length of core requests. However, internal table requests cannot exceed 4998 words each.
- 4) SDRP at present is programmed to reduce two specific reference pools. They are the Augmentation pool and the pre-Augmentation pools found on the ASUM and SUM masters, respectively. To allow reduction of any other reference pool, a new dictionary would have to be added to the program's environment.
- 5) Note that SDRP uses tape unit 4 as a scratch tape when change only printing is requested. A blank tape need not be assigned to the unit except under the change only printing option.

f. Operator Feedback

The operator should return to the programmer the on-line printout and/or the off-line tape listing. He should also indicate, if applicable, any errors in the function call message and the actions taken to correct them.

g. Recovery Procedures

SDRP is a relocatable program. It has no fixed addresses or entry points. No recovery is possible.

4. SDRP Outputs

a. General Description

SDRP writes its BCD coded information either on the on-line printer or on a BCD tape. The method of output is specified through the function call message.

The first record printed is the Before Core Record. Then each data file is printed as a unit of information. Following all of the data

files, the After Core Record is written (if there is one) and the job is terminated.

For each data file, the file number is printed and the Selective Listing Input messages are written along with the termination message. Data records follow.

In general, there are five types of output data: core dumps, trace records, reference pool records, console records, and internal table and item records. Each type of output data is prefaced on the printout by a heading line. The heading line indicates the type of data and when the data was recorded - before, after, or during.

b. Sample Output

A sample printout can be found on the following pages. No examples are given, but HCONSOLE, HCORE, and HTRACE identify inactivity data printouts. Operation codes are translated to mnemonic characters in the Before, After, and HCORE Core Records, but are left as octal numbers in all other cases. Also, when translating core records, if a 4-word line (with the exception of the last line) is found to contain all zero words, it is not printed. In a trace printout, two asterisks before the OP field indicate that the instruction references the address containing the instruction.

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	CORE RECORD	WORD 1	WORD 2	WORD 3	WORD 4
	LOCATION				
	01000	ISK 3 00004 SLJ 0 00766	SSH 0 01610 INT 1 00002	INT 1 00001 IJP 5 00760	ISK 2 00013 SLJ 0 00757
	01004	EMI 1 00000 EMI 4 00000	EMI 5 00001 EMI 6 00004	LDQ 0 01603 LDA 0 01602	LIS 0 00010 STA 0 01432
.					
.					
.					
04714	ZRO 0 00000 ZRO 0 00000	ZRO 0 00000	ZRO 0 00000	ZRO 0 00000	ZRO 0 00000
RANGE	01000 - 04717				

FILE 001

SELECTIVE LISTING INPUT MESSAGES LISTED BELOW

RECORD TESTTAB 0 47560B 0 0

RECORD TESTIT SDRP 11000B A 1 9

RECORD POOLA 0 0 AB 6000B 0 0 0

0.4.10

CONSOLE RECORD		INDEX REGISTERS		BUFFER REGISTERS		RECORDED BEFORE	
A REGISTER	54 3 0004 75 0 00766	1	03717	1	00 0 01604 00 0 01604		
B REGISTER	00 0 0000 00 0 00777	2	00005	2	50 3 01325 75 0 01325		
		3	01772	3	00 0 02356 00 0 02356		
COMPUTER CLOCK	74 0 32005 74 7 32000	4	00002	4	07 0 71523 06 0 00006		
		5	00004	5	07 0 00014 60 0 00006		
		6	00000	6	74 3 73573 75 0 00034		

TRACE		RECORD		COMMENTS									
P	OP	B	ADD	B+ADD	COMMENTS B+ADD	COMMENTS A	COMMENTS Q	I-1	I-2	I-3	I-4	I-5	I-6
12552U	**61	0	12552	12552	000000000000062	000000000000062	000000000000077	10103	0000	0006	0000	0000	0000
12552L	22	0	12551			000000000000062	000000000000077	10103	0000	0006	0000	0000	0000

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INTERNAL TABLE RECORD
TESTTAB 0 14675.00000000 1 -96327.79000000 2 .500000000000 3 6870.0000000000
RECORDED DURING AF 47560, PASS 7001

INTERNAL TABLE RECORD
BUFFER (UC) TELETYPE OUTPUT MESSAGE TABLE (CR)
RECORDED AFTER

POOLA RECORD
RECORDED AFTER
AE .0819918981
20926040.000
SBCD 0 4 PAD 1 PAD1 2 PAD2 3 PAD3
COOK 5 MAGU 6 VERLORT 7 etc.

CORE RECORD
LOCATION WORD 1 WORD 2 WORD 3 WORD 4
01004 ENI 1 00064 ENI 4 00007
LLS 0 00040 STA 0 01432

03404
RANGE 01000 - 04717
SLJ 0 07532 STQ 0 00165
ONLY CHANGED LOCATIONS WERE PRINTED

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5. SDRP Sample Input Deck

* CLR

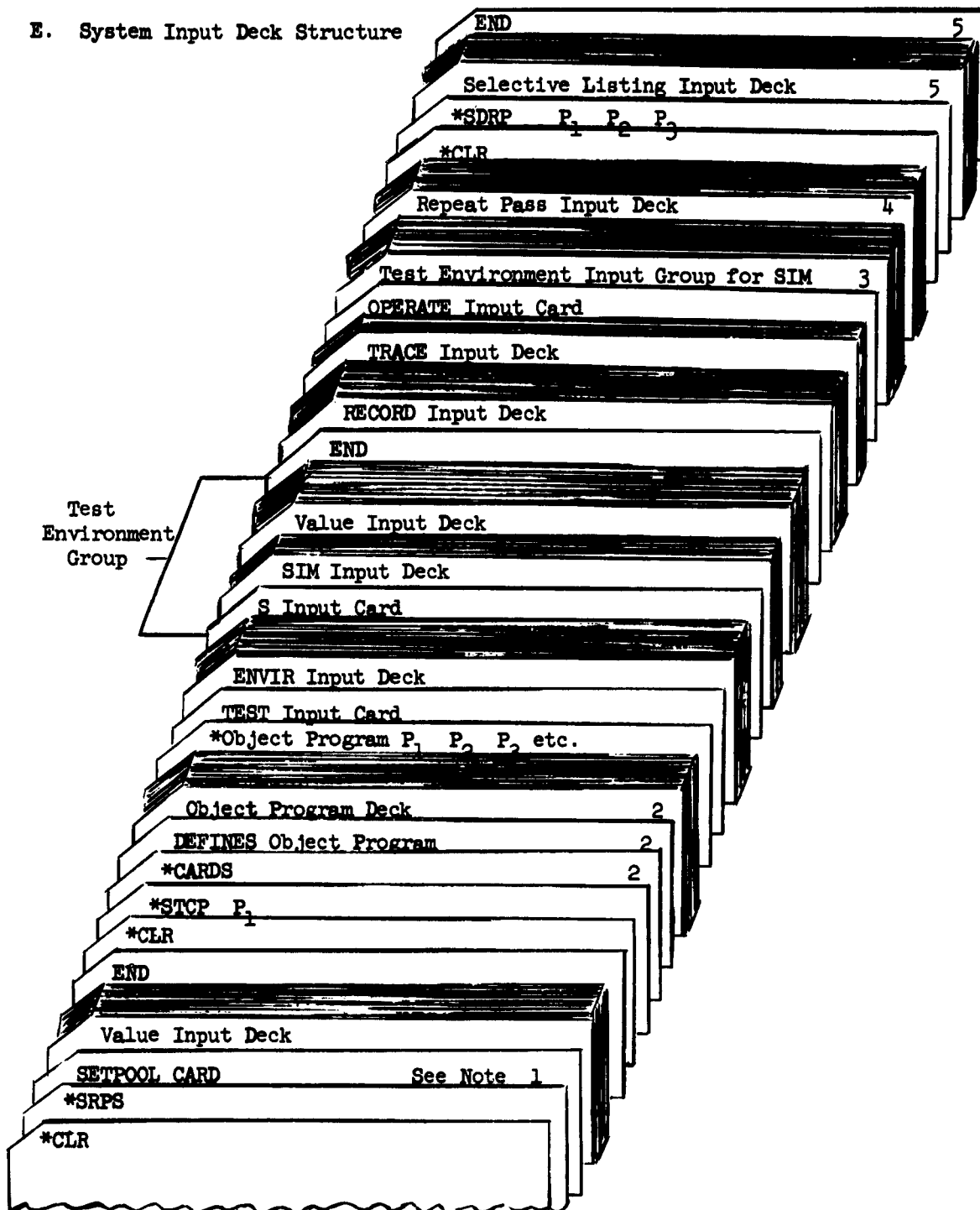
* SDRP 5 PRINTER CHANGE

RECORD AREA1 TESTPROG 70B AB 0 0

RECORD ITEM1 TESTPROG 21B BA 0 0

END

E. System Input Deck Structure



Notes:

1. If the deck is prestored, this input must be put in the card reader or entered by the typewriter.
2. The function requests in this section will be determined by the location of the object program. The example shown is for a binary deck of the object program. If on the other hand the object program was on the master tape and had corrections, the following sequence would be used:

*CARDS
CORRECT PROGRAM
Corrections
Term card

If, however, the object program did not require corrections, none of the "2" cards shown in the example, or described above, would be used.

3. A Test Environment Group is expected at this position in the deck for each SIM trap operated.
4. The Repeat Pass Input Deck is a deck of any of the inputs from ENVIR deck through the Test Environment Group. A Repeat Pass Input Deck is necessary for each repeat pass of the object program requested.
5. The inputs in this section must be in the card reader if the deck is prestored. There must be one group of these inputs for each repeat pass on the process tape.

APPENDIX

Value Formats Used

There are seven types of value formats used in the input fields.

1. BCD Word - a series of legal BCD characters not to exceed 8 characters.

ABCDEF

2. Octal Address or Constant - A sign and one or a series of octal (0-7) digits, not to exceed 16 digits, followed by a B. The B is the flag that indicates an octal number and must be present.

+ 77777777B

3. Decimal Constant - A sign and one or a series of decimal digits, not to exceed 12 digits. The number may be followed by one or two scaling factors. $E \pm D_1 D_2 \dots D_k$ decimal scaling and/or $S \pm D_1 D_2 \dots D_L$ binary scaling. A decimal point must not be used.

+ 19876E+3S+1

4. Floating Point Constant - A sign, one or a series of decimal digits, and a decimal point. The number may not exceed 12 digits in length. The decimal point must appear after the sign, within the 12 digits, or just after the last digit. The number may be followed by one or two scaling factors, $E \pm D_1 D_2 \dots D_k$ decimal scaling and/or $S \pm D_1 D_2 \dots D_L$ binary scaling.

+ 198.76E+3S+1

5. BCD Code - Two fields are used to enter BCD code. Both fields must be in the same input.

First Field - contains $BD_1 \dots D_k$ where B is the flag for BCD code and $D_1 \dots D_k$ is the total decimal number of BCD words desired.

Second Field - Any legal BCD character in parentheses, e.g., (ABCDE). A BCD coded word is generated for each 8 characters within the parentheses. The last word is filled in with blanks, if the total number of characters is not a multiple of 8. If the number of words generated is not equal to the number specified in the free field, words of BCD blanks are added until the desired number is reached.

If there are enough BCD characters to exceed one input, the parentheses must be closed and a \$ placed in the last field. The number of characters within the parentheses must be a multiple of 8, equal to the number specified in the first field, if the BCD code is to be continuous, e.g.

B2 (ABCDEFGH IJKLMN O P) \$

There are 16 characters within the parentheses, producing two full words of BCD code. Any additional BCD words added will leave no blanks between the P and the next character. If the second word had not had 8 characters, the right most character would have been filled with blanks, e.g.

B2 (ABCDEFGH IJKLM) \$

In this example the second word will have 3 blanks after the M.

The additional input, following the use of a \$, contains both fields as described above. If a \$ is used in the additional input, the rule for continuous BCD code also applies.

The right parentheses sign ")" is a legal BCD character within the parentheses only when it is not followed by a blank.

An example of a BCD entry:

B3 (THIS IS A TEST.)

The BCD code produced from this input is as follows:

Word 1 2370712220712220
Word 2 6120236522237320
Word 3 2020202020202020

6. Teletype Code - Two fields are used to enter teletype code. Both fields must be in the same input.

First Field - $TD_1 \dots D_K$

Where T is the flag for teletype code and $D_1 \dots D_K$ is the total decimal number of teletype code words desired.

Second Field - any legal teletype or special machine code character, e.g. (ABCDE).

A teletype code word is generated for each 8 characters within the parentheses. The last word is filled in with spaces if the total number of characters is not a multiple of 8. If the number of words generated is not equal to the number specified in the first field, words of space codes are added until the desired number is reached.

The teletype writer machine codes (carriage return, shift to letters, etc) are obtained by changing the conversion mode with a zero having a minus overpunch ($\bar{0}$). After a $\bar{0}$, the special characters for machine codes are expected.

R = Carriage return
U = Shift to figures
L = Shift to letters
F = Line feed
I = Ignore

The machine code mode of conversion is terminated by a $\bar{0}$. The $\bar{0}$ flags are not counted as characters or converted into teletype code, e.g. (AB $\bar{0}$ RU $\bar{0}$ CDEF) - the word of code produced would be:

3023023316222026

If there are enough teletype characters to exceed one input, the parentheses must be closed and a \$ placed in the last field. The number of characters within the parentheses must be a multiple of 8, equal to the number specified in the first field, if the teletype code is to be continuous, e.g.

T2 (ABCDEFGH IJKLMN OP) \$

There are 16 characters within the parentheses, producing two full words of teletype code. Any additional teletype words added will not have space codes between the P and the next characters. If the second word had not had 8 characters, the right most character would have been filled with spaces, e.g.

T2 (ABCDEFGH IJKLM) \$

In this example the second word has three space codes following the M.

The additional input, following the use of a \$, contains both fields described above. If a \$ is necessary in the additional input, the rule for continuous teletype code above also applies.

The right parentheses sign ")" is a legal teletype character within the parentheses only when it is not followed by a space.

An example of a teletype entry:

T3 (ORLOTHIS IS A TESTOUO.)

The teletype code produced from this input is as follows:

Word 1	0237010514240414
Word 2	2404300401202401
Word 3	3307040404040404

7. Typewriter Code - Two fields are used to enter typewriter code. Both fields must be in the same input.

First Field - $FD_1 \dots D_K$

Where F is the flag for typewriter code and $D_1 \dots D_K$ is the total decimal number of typewriter code words desired.

Second Field - any legal typewriter or special machine code character, e.g.

(ABCDE).

A typewriter code word is generated for each 8 characters within the parentheses. The last word is filled in with spaces if the total number of characters is not a multiple of 8. If the number of words generated is not equal to the number specified in the first field, words of space codes are added until the desired number is reached.

The typewriter machine codes (carriage return, shift to upper case, etc.) are obtained by changing the conversion mode with a zero having a minus overpunch ($\bar{0}$). After a $\bar{0}$, the special characters for machine codes are expected.

R = Carriage return

U = Shift to upper case

L = Shift to lower case

B = Backspace

T = Tab

The machine code mode of conversion is terminated by a $\bar{0}$. The $\bar{0}$ flags are not counted as characters or converted into typewriter code, e.g.

(A $\bar{0}$ RU $\bar{0}$ CDEF).

The word of code produced would be:

: 2023454716222026

If there are enough typewriter characters to exceed one input, the parentheses must be closed and a \$ placed in the last field. The number of characters within the parentheses must be a multiple of 8, equal to the number specified in the first field, if the typewriter code is

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(last page)

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to be continuous, e.g.

(ABCDEFGH IJKLMN O P) \$.

There are 16 characters within the parentheses, producing two full words of typewriter code. Any additional typewriter words added will not have space codes between the P and the next character. If the second word had not had 8 characters, the rightmost characters would have been filled with spaces, e.g.

F2 (ABCDEFGH IJKLM) \$

In this example the second word has three space codes following the M.

The additional input, following the use of a \$, contains both fields described above. If a \$ is necessary in the additional input, the rule for continuous typewriter code above also applies.

The right parentheses sign ")" is a legal typewriter character within the parentheses only when it is not followed by a space. An example of a typewriter entry:

F4 (ORUOTHIS IS A TEST.)

The typewriter code produced from this input is as follows:

Word 1	4547010514240414
Word 2	2404300401202401
Word 3	4204040404040404
Word 4	0404040404040404

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System Development Corporation,
Santa Monica, California
OPERATING INSTRUCTIONS FOR THE
PARAMETER TEST SYSTEM MILESTONE 7.
Scientific rept., TM-1138, by
C. R. Frey, E. L. Griffith, C. L. Remstad.
25 March 1963, 50p.
(Contract AF 19(628)-1648, Space Systems
Division Program, for Space Systems
Division, AFSC)

Unclassified report

DESCRIPTORS: Programming (Computers).
Satellite Networks.

Reports that the Parameter Test System
consists of three programs:

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1) the Reference Pool Simulator (SRPS),
sets the reference pool to predetermined
values; 2) Test Control (STCP), sets
additional environment such as tables,
items, and core locations before and
during program's operation, provides
dumps of tables, programs, and core
areas before, during and after the test,
allows a track of selected areas of the
object program, controls the start,
operation, and the end of the test,
and provides for emergency procedures
in case of certain test failures;
3) Data Reduction (SDRP), selectively
formats and list the test outputs.

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